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U.S.

Toxic Moss in Portland, Ore., Shakes City's Green Ideals

By **KIRK JOHNSON** MARCH 2, 2016

PORTLAND, Ore. — The 346 clumps of moss that science researchers from the United States Forest Service scraped from tree trunks and branches across this city looked as ordinary as moss gets — ancient, simple and common to the point of invisibility in the Pacific Northwest's palette of green.

But the moss had a riveting tale to tell, with shock waves that are still spreading.

Toxic heavy metals, notably cadmium, which can cause cancer and kidney malfunction, were detected in the samples, with high concentrations in particular around two glass factories in residential neighborhoods, both of which had used metals for coloring their products.

In a city that prides itself on being an environmental example to the world — from its throngs of bike commuters to its antisprawl development rules — the moss study results roared, producing an upheaval of surprise, anger and fear. Residents shouted or wept in public meetings last month, raging at state officials, who released the results and then found themselves blamed for not knowing what the factories were putting up their smokestacks.

On Tuesday, the director of Oregon's Department of Environmental Quality, Dick Pederson, resigned abruptly, saying he had health concerns that needed immediate care.

After the moss studies were released, local officials, who have said they are cautiously optimistic that public health impacts from the glass plants will in the end be minimal, raced in to take soil samples and set up air monitors. But residents near the plants were also cautioned last month to forgo, at least for now, even the spring rites of backyard gardening, until the test results can be further analyzed — a warning that sent another shiver through a city where "eat local" is almost a mantra.

"Because there is uncertainty, the gap is filled with fear," said Dr. Paul Lewis, the Multnomah County health officer.

Residents like Sarah Livingstone, 41, who lives about five blocks from one of the glass factories, said the moss study and its consequences had changed her life.

"It's the last thing I think of before I go to sleep and the first thing I think of in the morning," said Ms. Livingstone. Her 15-month-old daughter, Clara Ritter, tested positive for arsenic, which sent off alarm bells in the family even though doctors said it was within a normal range. "I don't know how we get back to normal," added her husband, Rex Ritter, 48, in an interview in their living room.

Even the Forest Service researchers who undertook the moss study — the first of its kind in the world, health experts and regulators said — were taken by surprise. The idea, they said, in keeping with their work for a federal agency that has "forest"

in its name, had been about demonstrating how trees add value in an urban setting. Measuring levels of pollution was not the goal of the research, let alone the discovery of a citywide grid of toxic hot spots.

"This wasn't at all what we set out to find," said Geoffrey Donovan, an economist who worked on the project with his research partner, Sarah Jovan, a moss and lichen expert.

The two glass companies, Uroboros Glass Studios and Bullseye Glass, both voluntarily stopped working with cadmium — used for making red, yellow and orange glass — and chromium, used in green and blue tints, after the moss results were announced in January.

But Daniel Schwoerer, a co-founder and the chief executive of Bullseye, said he thought glass-manufacturing might not be fully responsible. His factory, which opened in 1974 and has 140 workers, is also near a railroad yard, a cement plant and a metal-casting company.

"The D.E.Q. thinks we're responsible — we don't know," Mr. Schwoerer said in an interview, referring to the Department of Environmental Quality. "But we're going to do the right thing going forward."

Oregon's state epidemiologist and medical director of public health, Dr. Paul R. Cieslak, called the Forest Service study "genius" in looking where no one had ever thought to look. But the puzzle of science, anxiety and uncertainty that has resulted, he said, is messy.

And time consuming: The moss samples were gathered in late 2013, and the Forest Service team finished its analysis last May. The Department of Environmental Quality then did its own testing last fall to confirm what the moss was saying, and it released the results when they came in, in January.

"From a doctor's standpoint, they always tell us, 'Never order a test unless you know what you're going to do with the result,' " Dr. Cieslak said. "Now we're in this situation where we have all this data from the moss, and we're left struggling to figure out what does it all mean."

He said that because substances like cadmium are mainly considered risks to human health in long-term heavy exposures, and because the levels detected around the factories have so far been below the threshold of "acute," the alarm for the moment is low. The state has said that people who want to check their own cadmium exposure could do so through a urine test with their physician — and that the state would pay for people who could not afford it — but results are just starting tocome in.

"I think what we are going to end up telling people is that you are at some elevated risk, and the degree of elevation is likely to be small," Dr. Cieslak said.

Environmental groups and legal experts said the long-term importance could be in the moss itself, as a relatively low-cost research tool. If plants can, in a way, speak of what they have absorbed, then a door has been opened to a whole new arena of pollution research.

"We are potentially at the tip of an iceberg," said Wendy Wagner, a professor at the University of Texas at Austin School of Law who teaches environmental law. "With new tools of looking for things that we really haven't looked for before, we're going to be in for some surprises," she added.

Federal air pollution laws have mostly focused on overall, or ambient, air quality — especially from emissions like carbon monoxide and lead. Metals and other toxics are less extensively monitored, Professor Wagner and other experts said, as are small companies like the two glass factories.

Portland residents like Mary Peveto said that to her, the revelation of the cadmium hot spots was no surprise. Ms. Peveto, a co-founder and president of a group called Neighbors for Clean Air, became involved in pollution issues here in 2008 after a study found that schools in Portland — including her daughter's — had some of the worst results in the nation for industrial pollution deposits. That new hot spots are turning up all over again, she said, "shows that the system is still broken."

Portland's mayor, Charlie Hales, said he thought the shock from the moss study was compounded by Portland's self-image as a city that can have it all: industry and blue-collar factory jobs, but also clean air and water.

"We are an example to the world of the green, sustainable city, and so it's all the more dissonant," Mr. Hales said.

Mr. Donovan and Ms. Jovan at the Forest Service, meanwhile, are already planning to replicate their study in a new city this spring: Cincinnati.

Doctors at Cincinnati Children's Hospital Medical Center heard about the moss study and asked the researchers to go there and make a grid map like Portland's, which will be cross-matched against health and development studies in children in various neighborhoods there.

"The first step is creating that map," said Patrick Ryan, an associate professor of pediatrics at the center. "I haven't seen anything like it before."

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